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Resin Sampler for Studying Pine Trees' Resistance to Bark Beetle Attacks

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In North America, more pine trees are killed by bark beetles than by any other organism. Hundreds of millions of dollars are lost annually because bark beetles kill pines in forests, recreation areas, urban forests, and near homes. Because bark beetles are so small (about the size of a grain of rice), thousands of them must attack a tree before they can reproduce in the tree's phloem tissue—a process that usually kills the tree. Natural pheromones rapidly attract large numbers of beetles, making such attacks possible.

Trees defend themselves by producing resin, which oozes from attack sites and keeps beetles out. Resin flow is influenced by environmental, forest management, and genetic factors, allowing trees' resistance to infestation to be predicted with some degree of accuracy if the appropriate research studies are completed.

Because pines fend off attacking beetles by exuding resin, the quantity of resin flowing at attack sites is believed to be correlated to a tree's resistance to colonization. Sampling the quantity of resin produced by trees may help measure the tree's resistance to attack. Brian Strom from the U.S. Department of Agriculture's Southern Research Station in Pineville, LA, has been sampling resin production and developing ways to make the sampling more accurate and more efficient.

When collecting resin, a hole punch is used to remove a small plug of bark from the tree, exposing the sapwood tissue (the newly formed outer layer of wood). The sampling device may be placed over or under the hole to funnel resin into a vial. In the past, the flow of resin was measured by a variety of methods. Most used open containers that allowed contamination by rain and falling debris. Samples contaminated by rain are generally unusable, because the resin can't always be separated from the water.

One of the earlier sampling devices (figure 1) used a tin funnel attached to a tree with thumbtacks. A vial was attached with duct tape underneath the funnel. The vials were collected after 24 hours and the resin was weighed. Such sampling devices are no longer

Figure 1—One early sampler used a tin funnel tacked to a tree to collect resin.

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satisfactory because more trees need to be sampled over longer periods of time to address new questions. Rain contamination was a particular problem with the old devices.

The resin sampler developed by the Missoula Technology and Development Center (MTDC) and the Southern Research Station's Brian Strom (figure 2) is attached to

Figure 2—Final sampler design with the fastener holes outside the collection area.

the tree by two screws that hold it tight without interfering with the sampling area. One of the earlier prototypes used a single screw passing through the center of the collecting area to attach the collector to the tree (figure 3). The screw in the collection zone caused more resin to be produced than if the fasteners were located away from the collection area (figure 4).

The sampler is made from the same plastic as automobile gas caps. It is rugged, washable in petroleum solvents needed to remove pine resin, and reusable. Keith Windell, an engineer at MTDC, designed the sampler using the *Solidworks* 3-d modeling software. The collection vial is a standard threaded centrifuge tube, which is watertight and easily capped when storing samples. The centrifuge tube is available inexpensively from scientific suppliers.

Figure 3—An early design had a single fastener screw in the resin collection area. This design was abandoned because the screw was causing more resin to flow than would have flowed otherwise.

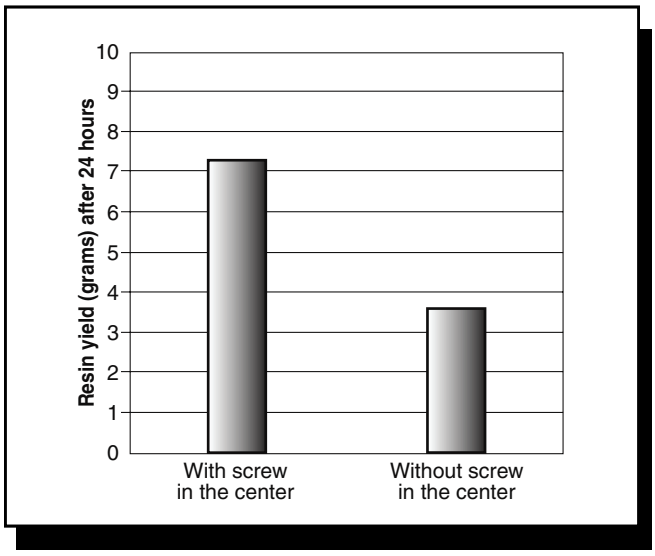

Figure 4—When the screw was in the collection zone, trees produced twice as much resin as when the screw was not there.

Conclusions

The new resin sampler is a valuable tool for studying the interactions between bark beetles and host trees. The sampler is inexpensive ($1.35), reusable, and watertight. This sampler will allow researchers and managers to conduct larger studies of tree resistance to bark beetle attacks.

About the Authors

Dick Karsky has been the forest health protection program leader since the fall of 1999. Dick has been a project leader at the Missoula Technology and Development Center in the resource areas of range, cooperative forestry, engineering, fire, reforestation and nurseries, residues, recreation, and forest health protection. He received a bachelor's degree in agricultural engineering from North Dakota State University and a master's degree in agricultural engineering from the University of Minnesota. He worked for industry before coming to the center in 1977.

Brian Strom is a research entomologist for the Southern Research Station in Pineville, LA. He received a bachelor's degree in forest science from the University of Wisconsin, a master's degree in forestry and entomology from North Carolina State University, and a Ph.D. in entomology from Louisiana State University. Brian works in the southern pine beetle ecology, behavior, and management research work unit.

Harold Thistle received a Ph.D. in plant science specializing in forest meteorology from the University of Connecticut in 1988. He is certified by the American Meteorological Society as a certified consulting meteorologist (CCM), and worked as a consultant in private industry before joining the center in 1992. He served as the center's program leader for forest health protection until 1998, developing modeling techniques that accurately describe transport of pesticides in the atmospheric surface layer and evaluating meteorological instrument systems for environmental monitoring. He now works with the Forest Health Technology Enterprise Team in Morgantown, WV.

Library Card

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Describes a sampling device that can be used to measure resin flow after a small plug of bark has been punched from a pine tree. Resin flow can be a measure of a pine tree's resistance to attack by bark beetles, tiny insects that can kill a tree if enough of them begin reproducing in the living tissue beneath the tree's bark. The new sampler is sealed, preventing the resin it collects from being contaminated by rain or debris. The collection vial is a standard threaded centrifuge tube. The sampler costs just $1.35, is reusable, and is watertight.

Keywords: forest health protection, insect pests, pitch out, sampling

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